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# VERIFICATION OF TRANSLATION

I, Takeshi SATO, Ph.D. of c/o IMP Building, 1-3-7, Shiromi, Chuo-ku, Osaka-shi, Osaka 540-0001 Japan, declare that I am well qualified as a translator of Japanese to English and that I have carefully translated the attached English language translation from the original document:

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published in Japanese; and that the attached translation is an accurate English translation of Japanese specification published under JP2003-52746A to the best of my knowledge and belief.

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(71)Applicant: KAO Corporation
(72)Inventor: Yoshifumi NIKI et al.
(74)Agent: Osamu Hatori et al.

(54)[Title] ABSORBENT ARTICLE

(57)[Abstract]
[PROBLEM] To provide an absorbent article capable of exerting a deodorizing effect and an antimicrobial effect with good balance, maintaining skin conditions and preventing degradation in absorption performance.
[SOLUTION] An absorbent article 1 is constituted by disposing a layer 8 mainly having a deodorizing effect and a layer 9 mainly having an antibacterial effect between a top sheet 2 and an absorbent core 4. A layer containing a chelating agent or an antioxidant is disposed between the top sheet 2 and the layer 9 mainly having an antibacterial effect. The layer 8 mainly having a deodorizing effect contains a deodorizer consisting of a porous particulate material and the layer 9 mainly having an antibacterial effect contains an antibacterial agent comprising silver, copper or zinc.

[Claim(s)]

[Claim 1]

An absorbent article comprising a fluid permeable surface sheet, a fluid impermeable back sheet and an absorbent core of liquid retention intervening between the both sheets, in which a layer mainly having a deodorizing effect, and a layer mainly having an antibacterial effect independent from the absorbent core are disposed between the top sheet and the absorbent core, and a layer containing a chelating agent or an antioxidant is disposed between the top sheet and the layer mainly having an antibacterial effect, wherein

the layer mainly having a deodorizing effect contains a deodorizer consisting of a porous particulate material, and

the layer mainly having an antibacterial effect contains an antibacterial agent comprising silver, copper, or zinc.

[Claim 2]

The absorbent article according to claim 1, further comprising a chelating agent or an antioxidant in the absorbent core.

[Claim 3]

The absorbent article according to claim 2, wherein the absorbent core contains superabsorbent polymer and the chelating agent or the antioxidant is disposed near a surface of the superabsorbent polymer.

[Claim 4]

The absorbent article according to claim 1, wherein the chelating agent is a water-insoluble particulate material.

[Claim 5]

The absorbent article according to claim 1, wherein the layer mainly having an antibacterial effect is disposed between the layer mainly having a deodorizing effect and the absorbent core, and the layer containing a chelating agent or an antioxidant is disposed between the top sheet and the layer mainly having a deodorizing effect, or the layer containing a chelating agent or an antioxidant is integrated with the layer mainly having a deodorizing effect by incorporating the chelating agent or the antioxidant in the layer mainly having a deodorizing effect.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to an absorbent article which has an antibacterial effect and a deodorizing effect together.

[0002]

[Background art and Problem to be solved by the Invention]

Conventionally, in absorbent articles such as a disposable diaper and the like, articles with a deodorizing effect have been proposed by using deodorizers such as zeolite and activated carbon to prevent odor of excrement from leaking out of a diaper.

[0003]

In absorbent articles, saprophytic bacteria generate from excrement and these saprophytic bacteria affect wearer's skins or cause offensive odor. Therefore, it is important to invest absorbent articles with an antibacterial effect as well as a deodorizing effect.

[0004]

However, in the conventional absorbent articles, it is difficult to combine exertion of a deodorizing effect and an antibacterial effect with safety and absorption performances demanded for absorbent articles.

[0005]

Thus, an object of the present invention is to provide an absorbent article combining exertion of a deodorizing effect and an antibacterial effect with safety and absorption performances.

[0006]

[Means for Solving the Problem]

The present inventors intensively studied and found that the above object can be achieved by suitably disposing a part exerting a deodorizing effect and a part exerting an antibacterial effect independently in an absorbent article, and optionally by properly disposing a part containing preferably a chelating agent or an antioxidant.

[0007]

The present invention has been made based on the above finding and provides an absorbent article comprising a fluid permeable surface sheet, a fluid impermeable back sheet and an absorbent core of liquid retention intervening between the both sheets, in which a layer mainly having a

deodorizing effect, and a layer mainly having an antibacterial effect independent from the absorbent core are disposed between the top sheet and the absorbent core, and a layer containing a chelating agent or an antioxidant is disposed between the top sheet and the layer mainly having an antibacterial effect, wherein the layer mainly having a deodorizing effect contains a deodorizer consisting of a porous particulate material, and the layer mainly having an antibacterial effect contains an antibacterial agent comprising silver, copper, or zinc.

[0008]

[Embodiment of the Invention]

Below, the present invention is explained with referring to drawings based on preferable embodiments. A partial fracture perspective view of a disposable diaper as an embodiment of the absorbent article of the present invention is shown in Drawing 1.

[0009]

A diaper 1 shown in Drawing 1 is worn with wears such as underwear and a diaper cover, and comprises a fluid permeable top sheet 2, a fluid impermeable back sheet 3 and an absorbent core 4 of liquid retention. The top sheet 2 and the back sheet 3 respectively extend outwards in a width direction of the diaper 1 from side edges of the absorbent core 4. Both of the extended sheets are joined to form flexible side flaps 5,5. Around a crotch part of the diaper 1, extensible elastic members 6,6 are disposed in the side flaps 5 so as to extend in a longitudinal direction of the diaper. The extensible elastic members 6 are fixed between the top sheet 2 and the back sheet 3.

[0010]

At a position slightly inward in a width direction from the both edges of the absorbent core 4 in the crotch part of the diaper 1, the diaper 1 is folded towards the top sheet so that parts of the top sheet face to each other. The parts of the top sheet are joined. Thereby, the side flaps 5 are forced to stand up at the crotch part of the diaper 1. In addition, it is not shown but an adhesive area for fixing the diaper 1 to a wear is located in a longitudinal direction of the diaper 1 in a middle part in a width direction of the back sheet 3. The adhesive area is protected with a release paper (not shown) prior to use.

[0011]

As the top sheet 2 and the back sheet 3, those conventionally known in the art may be used without any limitation. For example, as the top sheet 2, a nonwoven fabric or a perforated film made of a synthetic resin may be used. As the back sheet 3, a film made of a synthetic resin may be used. This film may be moisture permeable. As the absorbent core 4, a fiber structure made of a natural fiber such as pulp and cotton and a synthetic fiber such as polyethylene, polypropylene and polyester alone or their mixture and suitably incorporating particles of superabsorbent polymer may be used. When superabsorbent polymer is incorporated in the absorbent core 4, it is preferred that the absorbent core 4 contains a chelating agent or an antioxidant alone or their mixture. The reason for this will be explained later. Especially, it is preferred that a chelating agent or an antioxidant is disposed near a surface of the superabsorbent polymer because of the reason explained later. In order to dispose a chelating agent or an antioxidant near a surface of the superabsorbent polymer, for example, the superabsorbent polymer may be mixed and stirred with a chelating agent or an antioxidant.

[0012]

As superabsorbent polymer, a partial cross-linked polymer material having a carboxyl group or a carboxylate group such as a cross-linked polyacrylate, a cross-linked copolymer of vinyl alcohol-acrylate, a cross-linked graft copolymer of starch-acrylate and a cross-linked graft copolymer of poly(vinyl alcohol)-poly(maleic anhydrate), and a partial cross-linked polysaccharide such as a cross-linked carboxymethylcellulose salt may be used. Especially, from a view point of a water-absorbing property, it is preferred to use a cross-linked polyacrylate or a cross-linked graft copolymer of starch-acrylate, among them, a cross-linked polyacrylate is preferably used.

[0013]

As a chelating agent, a polyvalent-carboxylic acid derivative, a hydroxycarboxylic acid derivative, an iminodiacetate derivative, an organic acid amide derivative, *N*-acylated amino acid derivative, a phosphoric ester derivative, a sulfonic acid derivative, a polyvalent sulfonic acid derivative, a ß-diketone derivative, a tropolone derivative, a titanium compound and the like may be used. Especially, from a view point of safety, it is preferred to use a polyvalent-carboxylic acid derivative such as edetic acid

(ethylenediaminetetraacetic acid) or its salt; a polyvalent sulfonic acid derivative such as 1-hydroxyethylidene 1,1-disulfon acid; and a tropolone derivative such as hinokitiol and its salt and the like.

[0014]

As an antioxidant, a phenol derivative, a polyphenol derivative and the like may be used. Especially, from a view point of safety, it is preferred to use substances originated from plants such as a tea extract, tannin, chlorogenic acid, a Scutellaria root extract, a gentian root extract, apple polyphenol, tocopherol and the like.

[0015]

In the diaper 1 of this embodiment, as shown in Drawing 2, the absorbent core 4 is wrapped with the antibacterial deodorizing sheet 7. One side portion 7a and other side portion 7b of the antibacterial deodorizing sheet 7 overlap so that the antibacterial deodorizing sheet 7 wraps the absorbent core 4. The one side portion 7a and the other side portion 7b overlap in a middle part in a width direction of the absorbent core 4 and they are joined with a predetermined joining means. Thereby, the antibacterial deodorizing sheet 7 is disposed between the top sheet 2 and the absorbent core 4 and between the back sheet 3 and the absorbent core 4. In addition, as the embodiment shown in Drawing 2, it is preferred that a part where the both side portions 7a,7b of the antibacterial deodorizing sheet 7 overlap is located on the side of the back sheet and a part where there is no overlap is located on the side of the top sheet because most part of the deodorizing layer explained below locates on the side near skins and the deodorizing effect may exert strongly.

[0016]

As shown in Drawing 3, the antibacterial deodorizing sheet 7 has a three-layer structure, and a layer mainly having a deodorizing effect (hereinafter referred to as "deodorizing layer") 8 is disposed in the center, a layer mainly having an antibacterial effect (hereinafter referred to as "antibacterial layer") 9 is disposed on the downside of the deodorizing layer and a layer containing a water-insoluble chelating agent or an antioxidant (hereinafter referred to as "chelating layer") 10 is disposed on the upside of the deodorizing layer. The present inventors unexpectedly found that when the deodorizing layer 8 and the antibacterial layer 9 are disposed independently so that they do not coexist, a deodorizing effect and an

antibacterial effect are exerted with good balance. That is, if a deodorizing layer and an antibacterial layer coexist, agents in the respective layers adversely affect each other so that the deodorizing effect and the antibacterial effect are not exerted with good balance. In addition, by disposing the chelating layer 10 on the deodorizing layer 8 independent from the deodorizing layer 8 and the antibacterial layer 9, the deodorizing effect and the antibacterial effect are improved, proliferation of bacteria which occurs on the side of the top sheet rather than on the side of the deodorizing layer 8 can be prevented and a rough dry skin preventing effect may be enhanced.

[0017]

In the diaper 1 of this embodiment, the deodorizing layer 8 is disposed between the top sheet 2 and the absorbent core 4, and the chelating layer 10 is disposed between the deodorizing layer 8 and the top sheet 2. The antibacterial layer 9 is disposed between the deodorizing layer 8 and the absorbent core 4. As a result, excrement will contact in order of the chelating layer 10, the deodorizing layer 8, the antibacterial layer 9, and the absorbent core 4. Because of contacts in this order, the odor components in the excrement is first absorbed in the deodorizing layer 8 and the deodorizing effect is exerted, the antibacterial components (e.g., copper ions as explained below) in the antibacterial layer elute into the excrement to migrate into the side of the top sheet 2 and the side of the absorbent core 4 and then the whole of the diaper 1 is invested with the antibacterial effect. In addition, the antibacterial components will be captured by the chelating layer 10 on the side of the top sheet 2, and a new antibacterial layer is formed in the vicinity of the top sheet 2 to reduce the antibacterial components in the excrement near the top sheet 2. As a result, the antibacterial effect near the top sheet 2 is maintained with exerting an effect to alleviate adverse effects to indigenous bacteria maintaining healthy conditions of skins. On the other hand, it is possible that the antibacterial components which migrated towards the side of the absorbent core 4 adversely affect the superabsorbent polymer but as stated above, by disposing a chelating agent or an antioxidant near the superabsorbent polymer, the adverse effect of the antibacterial components against the superabsorbent polymer is alleviated to maintain the absorption power of the superabsorbent polymer to the excrement. Additionally, by using a

chelating agent or an antioxidant which has an antibacterial effect, due to migration of the antibacterial components from the antibacterial layer 9 and the inside of the absorbent core 4, an antibacterial effect and an effect that a territory of the antibacterial components extends more quickly are expected. Since the chelating agent and the antioxidant which has migrated in the excrement are captured in the deodorizing layer 8 to reduce the amount of those reaching the skin, an effect that the diaper 1 is invested with much higher safety is expected.

[0018]

The deodorizing layer 8 is a layer mainly having a deodorizing effect. The deodorizing layer 8 has fluid permeability and air permeability. The deodorizing layer 8 with these properties may be suitably constituted mainly with fibrous materials and papers made by a wet paper making method which contain a deodorizer.

[0019]

In the deodorizing layer 8, from a view point of sufficient exertion of strength and flexibility, the fibrous materials are incorporated preferably at 50 to 99 weight %, more preferably 70 to 97 weight % with respect to the weight of the deodorizing layer 8. As a fibrous material, fluid absorptive fibers, for example, wood pulp such as Nadelholz (needle leaf) Bleached Kraft Pulp (NBKP) and Laubholz (broad leaf) Bleached Kraft Pulp (LBKP), non-wood pulp such as straw and cotton, and the like are preferably used.

[0020]

In the deodorizing layer 8, from a view point of sufficient exertion of deodorizing effect and flexibility, the deodorizers are incorporated preferably at 1 to 50 weight %, more preferably 3 to 30 weight % with respect to the weight of the deodorizing layer 8. As a deodorizer, porous particulate materials are used because they can effectively adsorb steroids which are offensive odor components peculiar to excrement. As a deodorizer consisting of porous particulate materials, activated carbon, porous polymer, silica gel and the like are suitably used. Among them, it is preferred to use activated carbon and porous silica gel because the effect to adsorb steroids is particularly high.

[0021]

As activated carbon, it is preferred to use chemical activated carbon because they have much higher effect of adsorbing steroids. As chemical

activated carbon, zinc-chloride activated carbon and phosphoric acid activated carbon are used. From the same reason, as a porous polymer, it is preferred to use 2,6-diphenyl-*p*-phenylene oxide base polymer, a divinylbenzene-styrene copolymer and the like.

[0022]

It is also preferred to incorporate a binder fiber in the deodorizing layer 8 in order to enhance its strength. From a view point of sufficient exertion of strength, the binder fiber is incorporated preferably at 0.1 to 5 weight %, more preferably 1 to 2.5 weight % with respect to the weight of the deodorizing layer 8. As a binder fiber, a polyethylene fiber, a poly(vinyl alcohol) fiber, a carboxymethylcellulose fiber and the like are used.

[0023]

The weight of the deodorizing layer 8 is preferably15 to 50 g/m$^2$, more preferably 20 to 35 g/m$^2$ from a view point of sufficient exertion of strength and flexibility.

[0024]

In the deodorizing layer 8, a further effect may be invested in addition to the deodorizing effect. For example, when activated carbon treated with an acid is used as a deodorizer, since this activated carbon becomes weakly acidic to exert a skin care effect, the deodorizing layer 8 has mainly a deodorizing effect and therefore has additionally a skin care effect.

[0025]

The antibacterial layer 9 is a layer mainly having an antibacterial effect. The antibacterial layer 9 has fluid permeability and air permeability as same as the deodorizing layer 8. The antibacterial layer 9 with these properties may be suitably constituted mainly with fibrous materials and papers made by a wet paper making method which contain an antibacterial agent.

[0026]

The fibrous materials used in the antibacterial layer 9 are similar to the fibrous materials used in the deodorizing layer 8. From a view point of sufficient exertion of strength, flexibility and an antibacterial effect, the fibrous materials are incorporated preferably at 90 to 99.9 weight %, more preferably 95 to 99.7 weight % with respect to the weight of the antibacterial layer 9.

[0027]

As an antibacterial agent, an antibacterial agent comprising silver, copper, or zinc is used. Particularly, since an antibacterial effect is effectively exerted, it is preferred to use an antibacterial agent which exerts its antibacterial effect only after contacting with a body fluid such as urine. As an antibacterial agent which exerts its antibacterial effect only after contacting with a body fluid, carboxylic acid derivatives, especially carboxymethyl-modified cellulose compounds on the surface of which the above mentioned metal ions attach (hereinafter referred to as "metal CMC") are suitably used.

[0028]

As metal CMC, a compound which contains silver, copper or zinc as metal is preferable from a view point of high antibacterial effect. A commercialized product may be used as metal CMC. For example, "Clean Sky (Trade Name)" manufactured by Kohjin Co. Ltd., which is copper CMC, may be used. From a view point of sufficient exertion of an antibacterial effect and reduction of production cost, metal CMC is incorporated preferably at $1.0 \times 10^{-3}$ to 5.0 weight %, more preferably $5.0 \times 10^{-3}$ to 2.0 weight % with respect to the weight of the antibacterial layer 9.

[0029]

The weight of the antibacterial layer 9 is preferably 10 to 50 $g/m^2$, more preferably 15 to 25 $g/m^2$ from a view point of combination of strength with flexibility and exertion of an antibacterial effect.

[0030]

In the antibacterial layer 9, a further effect may be invested in addition to the antibacterial effect. For example, when the above mentioned metal CMC is used as an antibacterial agent, since metal CMC has slightly a deodorizing effect, the antibacterial layer 9 has mainly an antibacterial effect and therefore has additionally a deodorizing effect.

[0031]

The chelating layer 10 contains a chelating agent or an antioxidant. The chelating layer 10 has fluid permeability and air permeability as same as the deodorizing layer 8 and the antibacterial layer 9. The chelating layer 10 with these properties may be suitably constituted mainly with fibrous materials and papers made by a wet paper making method which contain a chelating agent or an antioxidant.

[0032]

The fibrous materials used in the chelating layer 10 are similar to the fibrous materials used in the deodorizing layer 8 and the antibacterial layer 9. From a view point of sufficient exertion of strength and flexibility, the fibrous materials are incorporated preferably at 50 to 99 weight %, more preferably 70 to 97 weight % with respect to the weight of the chelating layer 10.

[0033]

As the chelating agent, those conventionally known in the art may be used without any limitation. For example, a chelating agent identical to or different from those contained in the absorbent core 4 may be used. Especially, from a view point of safety, it is preferred to use a chelating agent consisting of a water-insoluble particulate material. As a chelating agent consisting of a water-insoluble particulate material, clay minerals, in particular, zeolite, montmorillonite and the like are suitably used.

[0034]

From a view point of sufficient exertion of a chelating effect and improvement of production stability and, in turn, reduction of production cost, chelating agents are incorporated preferably at 1 to 50 weight %, more preferably 3 to 30 weight % with respect to the weight of the chelating layer 10.

[0035]

On the other hand, as an antioxidant used for the chelating layer 10, those mentioned above as an antioxidant incorporated in an absorbent core may be used. The amount of the antioxidant in the chelating layer 10 may be equivalent to the amount of the chelating agent in the layer.

[0036]

The weight of the chelating layer 10 is preferably 10 to 50 $g/m^2$, more preferably 15 to 25 $g/m^2$ from a view point of combination of strength with flexibility and sufficient exertion of a chelating effect.

[0037]

In the chelating layer 10, a further effect may be invested in addition to effects which a chelating agent and an antioxidant mainly have. For example, when zeolite is used as a chelating agent, since zeolite has slightly a deodorizing effect, the chelating layer 10 has mainly a chelating effect and therefore has additionally a deodorizing effect.

[0038]

In this embodiment, as shown in Drawing 3, one sheet of the antibacterial deodorizing sheet 7 is constituted with one layer of the deodorizing layer 8, one layer of the antibacterial layer 9 and one layer of the chelating layer 10. Additionally, the deodorizing layer 8 has a width narrower than those for the antibacterial layer 9 and the chelating layer 10. As a result, the antibacterial layer 9 and the chelating layer 10 respectively cover the upper and down sides of the deodorizing layer 8, and further extend outwards from the right and left edges of the deodorizing layer 8. The extended parts of the antibacterial layer 9 and the chelating layer 10 are joined to each other by using an adhesion or by combination. Therefore, in the antibacterial deodorizing sheet 7, the deodorizing layer 8 does not exist through both the side portions 7a,7b. In the antibacterial deodorizing sheet 7 with the above mentioned structure, since both the side portions 7a,7b of the antibacterial deodorizing sheet 7 are enclosed with the antibacterial layer 9 and the chelating layer 10, the deodorizer contained in sheet 7 is prevented from falling off during use of the diaper 1.

[0039]

The widths of the side portions 7a,7b of the antibacterial deodorizing sheet 7 is preferably 0.1 to 10 cm, more preferably 0.5 to 5 cm from a view point of prevention of falling-off of a deodorizer, efficiency of a deodorizer and working stability of an antibacterial deodorizing sheet.

[0040]

The antibacterial deodorizing sheet 7 is suitably manufactured, for example, by the following method. First, slurry containing fibrous raw materials and a deodorizer and, optionally a binder fiber is used as a paper-making raw material to manufacture a deodorizing layer by a usual wet paper-making method. Separately from this, slurry containing fibrous raw materials and an antibacterial agent is used as a paper-making raw material to manufacture an antibacterial layer by a wet paper-making method. In addition, slurry containing fibrous raw material and a chelating agent is used to manufacture a chelating layer by a wet paper-making method. The antibacterial deodorizing sheet 7 in which a deodorizing layer intervenes between an antibacterial layer and a chelating layer may be obtained by combining on a paper machine or by laminating with an adhesion on a laminator the obtained deodorizing layer, the antibacterial layer and the chelating layer.

[0041]

The present invention is not limited to the above embodiments. For example, the antibacterial deodorizing sheet 7 was a three-layer structure in the above embodiment. However, as other embodiments, when a deodorizing layer has a function of a chelating layer (for example, the case where a chelating agent or an antioxidant is incorporated in a deodorizing layer), the above antibacterial deodorizing sheet may be constituted in a form of a three-layer structure consisting of a pulp sheet layer, a deodorizing layer integrated with a chelating layer and an antibacterial layer or a two-layer structure consisting of one layer of a deodorizing layer integrated with a chelating layer and one layer of an antibacterial layer.

[0042]

Although the deodorizing layer 8 and the antibacterial layer 9 adjoined in the above embodiment, a layer which has other functions may optionally intervene between the both layers.

[0043]

The present invention may be applied not only to a disposable diaper and also to other absorbent articles such as sanitary napkins, incontinence pads and the like.

[0044]

[Examples]

In the following examples, unless it is mentioned otherwise, "%" indicates "weight %."

[0045]

[Example 1]

A deodorizing layer having a dry basis weight of 30 g/m$^2$ was made by a wet paper-making method from slurry containing pulp, zinc-chloride activated carbon and a binder fiber (poly(vinyl alcohol)) was used as a paper-making raw material to manufacture. In the deodorizing layer, the percentage of the pulp was 82.7 %, the percentage of the zinc-chloride activated carbon was 16.5 % and the percentage of the binder fiber was 0.8 %.

[0046]

Separately from this, an antibacterial layer having a dry basis weight of 16 g/m$^2$ was made by a wet paper-making method from slurry containing pulp and copper CMC ["Clean Sky (Trade Name)" manufactured

by Kohjin Co. Ltd.] as a paper-making raw material. In the antibacterial layer, the percentage of the pulp was 99 % and the percentage of the copper CMC was 1 %.

[0047]

In addition, a chelating layer having a dry basis weight of 16 g/m$^2$ was made by a wet paper-making method from slurry containing pulp and zeolite as a paper-making raw material. In the chelating layer, the percentage of the pulp was 85 % and the percentage of zeolite was 15 %.

[0048]

During the respective layers were wet, an antibacterial deodorizing sheet having a structure shown in Drawing 3 was obtained by laying the antibacterial layer and the chelating layer respectively on both sides of the deodorizing layer by combination. An absorbent core consisting of a mixture of pulp, superabsorbent polymer and disodium edetate (EDTA2Na) (superabsorbent polymer:EDTA2Na=4:1) was wrapped with the obtained antibacterial deodorizing sheet as shown in Drawing 2. At this time, the chelating layer was oriented outwards so that the antibacterial layer faces to the absorbent core. Then, on the upper and lower sides, the top sheet consisting of a suction heat bond nonwoben fabric and the back sheet consisting of a polyethylene film were disposed to obtain a disposable diaper having a structure shown in Drawing 1.

[0049]

[Example 2]

A disposable diaper was obtained similarly to Example 1, except that in place of the deodorizing layer containing zinc-chloride activated carbon, a substance obtained by putting a 7:3 mixture of divinylbenzene-styrene copolymer particles and zeolite particles between two pulp sheets having a weight of 16 g/m$^2$ and fixing them with a binder was used as a deodorizing chelating layer and a chelating layer was not used to form the antibacterial deodorizing layer 2 into a two-layer structure. At this time, the deodorizing chelating layer was oriented outwards so that the antibacterial layer faces to the absorbent core. In the deodorizing chelating layer, the percentage of the pulp was 77 %, divinylbenzene-styrene copolymer/zeolite was 22 % and the percentage of the binder fibers was 1 %.

[0050]

[Example 3]

A disposable diaper was obtained similarly to Example 1, except that EDTA2Na was not incorporated in the absorbent core.

[0051]

[Comparative Example 1]

A disposable diaper was obtained similarly to Example 1, except that zinc-chloride activated carbon was not incorporated in the deodorizing layer.

[0052]

[Comparative Example 2]

A disposable diaper was obtained similarly to Example 1, except that copper CMC was not incorporated in the antibacterial layer.

[0053]

[Comparative Example 3]

A disposable diaper was obtained similarly to Example 1, except that zeolite was not incorporated in the chelating layer.

[0054]

[Comparative Example 4]

A disposable diaper was obtained similarly to Example 1, except that zinc-chloride activated carbon was not incorporated in the deodorizing layer and that EDTA2Na was not incorporated in the absorbent core.

[0055]

[Comparative Example 5]

A disposable diaper was obtained similarly to Example 1, except that zinc-chloride activated carbon was not incorporated in the deodorizing layer and that zeolite was not incorporated in the chelating layer.

[0056]

[Comparative Example 6]

A disposable diaper was obtained similarly to Example 1, except that zeolite was not incorporated in the chelating layer and that EDTA2Na was not incorporated in the absorbent core.

[0057]

[Performance Evaluation]

For the diapers obtained in the above Examples and the Comparative Examples, deodorizing effects, antibacterial effects and decomposition-preventing effects for superabsorbent polymer were evaluated by the following methods. Results are shown in Table 1 below.

[0058]

[Deodorizing effect]

100 g of human urine was poured into a disposable diaper, and after settling for 10 minutes, six monitors estimated the odor generated from the disposable diaper according to the following six-grade criteria. A smaller value means a better impression.

5: An odor much stronger than the original odor is sensed.

4: An odor stronger than the original odor is sensed.

3: An odor does not change.

2: An odor weaker than the original odor is sensed.

1: An odor much weaker than the original odor is sensed.

0: Odorless

[0059]

[Antibacterial Effect 1]

Artificial urine containing a predetermined amount of *Escherichia coli* which was prepared by a method described below was poured into a diaper sample which was prepared by a method described below and it was stored in a 30°C circumstance. After 24-hour storage, the sample was placed in a physiological saline solution exceeding the amount of the saturated absorptive amount of the sample and stirred. The solution was filtered and the number of bacteria in the solution was measured. Based on the measured number of bacteria, the antibacterial effects were evaluated according to the following criteria comparing with Example 3 as a control.

- : Proliferation of the bacteria is suppressed more than the control.

+ : Proliferation of the bacteria is greater than or equivalent to the control.

[0060]

Preparation of Artificial Urine containing *Escherichia coli*

*Escherichia coli* was added to artificial urine sterilized with a sterilization filter unit (Product Name: NALGENE, Pore size: 0.45 μm) so that the number of bacteria becomes $10^4$/ml.

Preparation of Diaper Sample

A diaper is cut into 100mm x 50 mm size pieces and they are sterilized in an autoclave at 121°C for 20 minutes (packed with a poly(vinylidene chloride) film).

[0061]

[Antibacterial effect 2]

Artificial urine sterilized with a sterilization filter unit (Product Name: NALGENE, Pore size: 0.45 μm) was poured into a diaper sample prepared by a similar method as described in [Antibacterial effect 1]. Then, a calico No. 3 cloth (100 mm x 50 mm) sterilized in an autoclave at 121°C for 20 minutes was mounted on the top sheet. The calico No. 3 cloth was impregnated with 0.5 ml of a physiological saline solution containing a predetermined number of *Staphylococcus epidermidis* which was prepared by a method described below. The sample was stored for 24 hours with applying a load of 45 g/cm$^2$ in a 30°C circumstance. After completion of the storage, the calico No. 3 cloth was place in a physiological saline solution exceeding the amount of the saturated absorptive amount of the sample and stirred. The solution was filtered and the number of bacteria in the solution was measured. Based on the measured number of bacteria, the antibacterial effects were evaluated according to the following criteria comparing with Example 3 as a control.

- : Proliferation of the bacteria is suppressed more than the control.

+ : Proliferation of the bacteria is greater than or equivalent to the control.

[0062]

Preparation of Artificial Urine containing *Staphylococcus epidermidis*

*Staphylococcus epidermidis* was added to artificial urine sterilized with a sterilization filter unit (Product Name: NALGENE, Pore size: 0.45 μm) so that the number of bacteria becomes $10^4$/ml.

[0063]

[Decomposition preventing effect on Superabsorbent polymer]

100 cc of physiological saline solutions containing 500 ppm of *L*-ascorbic acid were poured into the diaper samples obtained in the Examples and the Comparative Examples. Then, those diaper samples were settled in a thermostat oven at 37°C. After 6 hours, the decomposition states of the superabsorbent polymers were observed visually to evaluate decomposition preventing effects according to the following criteria.

A: The superabsorbent polymer does not decompose and maintains its water-retention property.

B: The superabsorbent polymer partially decomposes and looses its shape, but maintains its water-retention property.

C: The superabsorbent polymer heavily melts (decomposes) to become liquid, and loses its water-retention property.

[0064]

[Table 1]

| | Deodorizing Effect | Antibacterial Effect 1 (*E. coli*) | Antibacterial Effect 2 (S. *epidermidis*) | Decomposition Preventing Effect on Superabsorbent Polymer |
|---|---|---|---|---|
| Example 1 | 0.8 | - | + | A |
| Example 2 | 1 | - | + | A |
| Example 3 | 0.8 | - | + | C |
| Comparative Example 1 | 2.5 | - | + | A |
| Comparative Example 2 | 1 | + | + | A |
| Comparative Example 3 | 1 | - | - | A |
| Comparative Example 4 | 2.5 | - | + | C |
| Comparative Example 5 | 2.7 | - | - | A |
| Comparative Example 6 | 1 | - | - | C |

[0065]

It is clear from the results shown in Table 1 that the diapers of Examples 1 to 3 comprising a sheet member which contains a deodorizer, an antibacterial agent comprising a metal and a chelating agent are excellent in a deodorizing effect and an antibacterial effect on their diaper bodies and they have a skin damage preventing effect because their impacts on dermal indigenous bacteria which protect skin surfaces were weak. The deodorizing effect and the skin damage preventing effect were particularly significant in the diaper of Example 1 in which the chelating layer is disposed nearer the top sheet than the deodorizing layer comparing with the diaper of Example 2 in which the chelating agent is incorporated in the deodorant layer. It is found that degradation of the absorbing property accompanied by decomposition of the superabsorbent polymer caused by

metal ions may be prevented by incorporating a chelating agent additionally in the absorbent core. On the other hand, it is recognized that Comparative Examples lack any of a deodorizing effect, an antibacterial effect and a skin damage preventing effect.

[0066]

[Effect of the Invention]

According to the absorbent article of the present invention, users can more safely and more effectively prevent bacillus contamination and generating of an offensive odor from excrement and degradation and decomposition of superabsorbent polymer.

[Brief Description of the Drawings]

[Drawing 1] A partial fractured perspective view showing a disposable diaper as an embodiment of the absorbent article of the present invention.

[Drawing 2] A cross-sectional view in a width direction of an absorbent core used in the disposable diaper shown in Drawing 1.

[Drawing 3] A cross-sectional view in a width direction of an antibacterial deodorizing sheet used in the absorbent core shown in Drawing 1.

[Description of Symbols]

1 Disposable diaper (absorbent article)
2 Top sheet
3 Back sheet
4 Absorbent core
5 Side flap
6 Extensible elastic member
7 Antibacterial deodorizing sheet
8 Deodorizing layer
9 Antibacterial layer
10 Chelating layer